Communications Research Centre Canada
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# Eye on Technology

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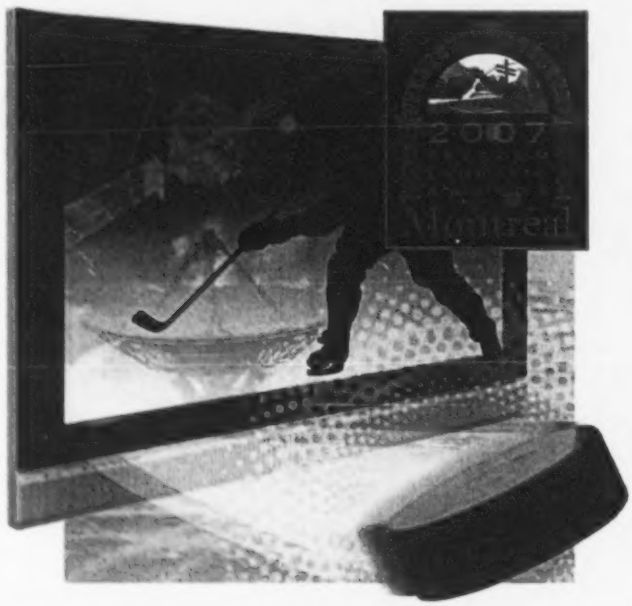
## CRC's Hall of Fame induction brings back hockey memories




*The Hermes satellite was a major CRC milestone, and was used to broadcast the first NHL playoff game across the western hemisphere in 1978.*

Canada's Telecommunications Hall of Fame has selected the Communications Research Centre Canada (CRC) as the recipient of the 2007 "Special Recognition Award." The award, granted to CRC and its predecessor, the Defence Research Telecommunications Establishment (DRTE), honors the federal laboratory's ongoing excellence in the research and development of Canada's telecommunications technologies.

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Throughout CRC's rich history, one of the most notable technology milestones is the Hermes satellite, created and developed in Ottawa and launched into orbit in 1976. With the recent denouement of the latest NHL season during which the Ottawa Senators went all the way to the final playoff round, it seems a fitting time to commemorate satellite technology, which brings our national pastime into Canadian homes.

While Hermes and hockey may seem to be worlds apart, they actually have a significant link in history. In fact, it was nearly 30 years ago today that the first-ever, direct-to-home satellite broadcast of an NHL play-off game was broadcast from the labs of CRC across the western hemisphere. A Canadian diplomat stationed in South America was familiar with the Hermes program, and knew that a hockey broadcast was feasible. He put in a special request which enabled him and a group of Canadian expatriates to watch the NHL game from the embassy in Lima, Peru. A revolution in its time, Hermes spawned the use of satellite technology in treating the annual epidemic known as playoff fever.

Dave Halayko, a long-time researcher with CRC's Satellite Communications branch, was part of the team working on the Hockey Night in Canada experiment back in 1978.

"They went into sudden death overtime," Halayko recalls of the Montreal Canadiens match-up against the Boston Bruins. "The problem was that the spacecraft antennas were to be re-directed to the USA at midnight and they would not be able to see the end of the game. Fortunately, the Habs scored just before we had to move them."

Fittingly, that first telecast game was won by the Canadiens en route to a third straight Stanley Cup win, defeating the Bruins in a six-game series.

Canada was the third country behind Russia and the United States to enter the "space race" with the 1962 launch of Alouette, but was the first to capitalize on the commercial potential of satellite broadcast technology.

CRC President Veena Rawat credits the Hermes technology as a giant step forward for Canada.

"There are places in the country where you can't have anything but satellite communication," says Rawat. "So it was extremely important to have this broadcast technology, not only on the entertainment side but also for tele-education and tele-health applications. Today, the satellites are used for widening broadband access to rural and remote areas."

CRC will be further honored at the Telecom Laureate Award ceremonies and gala dinner, taking place in Montréal in October.

## *CRC Scores a Satellite "Hat Trick"*

If satellite systems were goals in a competitive hockey game, the Communications Research Centre Canada (CRC) could claim an impressive "hat trick" as a key player in the three phases of development of Cospas-Sarsat.

Cospas-Sarsat is a renowned collection of satellite systems that work as one. Search And Rescue Satellite-Aided Tracking (SARSAT) is operated by Canada, France and the United States, while Cospas performs the equivalent function in Russia. Now approaching a quarter-century of service, this international satellite system provides alert and location information to search-and-rescue services throughout the world. To date, Cospas-Sarsat has helped save over 20,000 lives, of which more than 1,000 have been in Canada. Each month, about 100 people are rescued from distress situations, ranging from plane crashes and boating accidents to hiking mishaps.

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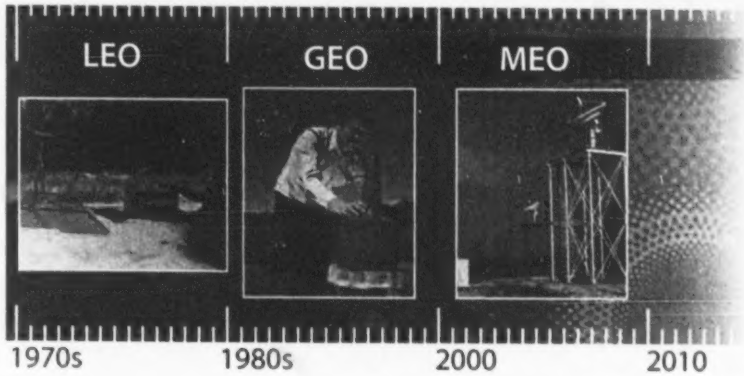
*The Cospas-Sarsat system has undergone three major development phases since its inception nearly 25 years ago. Researchers anticipate the MEOSAR system will replace the LEOSAR and GEOSAR systems by 2010.*




The future of Cospas-Sarsat will be realized through the third phase of development, based on a Medium-Earth Orbit Search-and-Rescue (MEOSAR) system. The CRC is an active participant in this current project, along with the Canadian Space Agency, EMS Satcom and NASA. The MEOSAR system, now at the prototype stage, will offer improved beacon detection and will overcome the time and coverage limitations of its two predecessors, the Low-Earth Orbit Search-and-Rescue (LEOSAR)/ Geostationary-Earth Orbit Search-and-Rescue (GEOSAR) system.

While the MEOSAR system consists of both a satellite and a ground station, CRC's role is focused on the research and development of the ground-receiving equipment. A prototype Medium-Earth Orbit Local User Terminal (MEOLUT) station, installed in 2006 at CRC, is making use of experimental equipment on satellites in orbit to evaluate the new MEOSAR system. CRC's MEOLUT station is one of only two such facilities in the world, with U.S.-based NASA being the second. There is some technical exchange of data between CRC and NASA during testing exercises, and both ground stations are already demonstrating the great potential of the MEOSAR system.

Comprised of many satellites in MEO at about 20,000 km, the prototype system can relay 406 MHz beacon signals to the MEOLUT station. By operating at a higher orbit than LEO, MEOSAR is able to "see" a greater area of earth, resulting in faster detection of a distress beacon. It also moves more slowly over the earth's surface, giving a greater chance of detecting a beacon. Researchers at CRC and Canadian industry are using this experimental system to develop more effective transmission parameters, made possible by the latest developments in computing power and speed. This system will quickly compute beacon locations by ranging or triangulating signals received via multiple satellites, using techniques similar to satellite navigation (i.e. GPS), but in reverse since the user activates a transmitter rather than a receiver.

In spring 2007, CRC began MEOSAR testing with its MEOLUT in Ottawa, Canada capturing test signals transmitted from Centre National d'Etudes Spatiales (CNES) in Toulouse, France via MEO satellites as they pass over the Atlantic Ocean. Currently, plans are being made to have 406 MHz SAR payloads on future global navigation satellite systems (GNSS), such as USA's GPS, Russia's GLONASS and Europe's new Galileo system in the next few years.

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Adding the MEOSAR enhancement will be like moving from a slow, dial-up Internet connection to a high-speed, always-on connection. In addition to continuous global coverage, the system will provide more reliable reception of beacon signals by multiple signal paths. MEOSAR also enables near-instantaneous detection and location of beacons, plus the ability to track moving beacons on a life raft or on an aircraft even before it crashes.

The technology behind Cospas-Sarsat has been linked to CRC since the beginning. Back in the 70s, Canada conducted experiments with the space agencies of USA and France that led to the creation of a satellite-aided search-and-rescue system. In 1976, the proof-of-concept demonstration was carried out at CRC, using a modified distress beacon operating through an amateur radio satellite. Today, close to 40 countries are members of the Cospas-Sarsat program, which recently moved its headquarters from London, England to Montréal, Canada.

CRC's ongoing work with the Cospas-Sarsat MEOSAR system will ensure that both search and rescue forces and 406 MHz beacon users worldwide will have the optimum distress alerting and locating service for many years to come.

(Adapted with text from "MEOSAR to the Rescue" by Jim King, published in EMS SATCOM Quarterly, January 31, 2007.)

## *Music instruction hits a high note with Broadband Virtual Camera technology*

The Communications Research Centre Canada (CRC) is fine-tuning its broadband technology tools in an effort to improve the video and audio quality of its real-time VirtualClassroom sessions.

On June 12, CRC's Broadband Applications and Demonstration Laboratory (BADLAB) in Ottawa tested the Broadband Virtual Camera (BVCam) tool while enabling students from a music academy in Finland to receive violin instruction from Pinchas Zuckerman, Music Director for Canada's National Arts Centre (NAC) Orchestra.

*Pinchas Zukerman connected with violin students in Finland using broadband technology in CRC's BADLAB.*

Zuckerman, who is arguably the world's top violinist, gave virtual, one-on-one instruction to senior-level students using the BADLAB's high-definition video conferencing screens. As the students performed complex concertos from renowned composers such as Mozart and Brahms, Zuckerman studied their technique and provided detailed comments for improvement. He also performed exemplary passages for the students on his own violin.

The week after the live session, the BVCam was used to enable follow-up, asynchronous sessions between Zukerman and the violin students in Finland. The students posted videos on a BVCam server for Zukerman to view, and he then posted his instructional response to the musical problems presented by the students. The one-minute video responses by Zukerman served as either reinforcement of instruction provided in the earlier synchronous session, or addressed new musical challenges identified by the students.

Video requests and responses can be stored in a video repository for future student and teacher reference and reflection.

In addition to music education, the asynchronous BVCam application is being tested as a tool to provide expert mentoring in support of health education and medical services in developing countries.

The VirtualClassroom program has been co-managed by CRC and the National Research Council (NRC) for over 10 years. Using high-speed (10 MB to 1 GB) fibre optic and bidirectional satellite connections (500 kb to 1 MB) as well as broadband visual communications tools, the VirtualClassroom offers media-interactive learning environments to students within Canada and around the world.

A group of music educators attended the June 12 VirtualClassroom violin session alongside the students in Finland. They are working to put together a proposal for an ongoing broadband music program.

### *New Lab Facilities at CRC*

The Communications Research Centre Canada (CRC) opened its doors to two state-of-the-art research laboratories on June 21, 2007.

A small group of guests convened for a networking breakfast and a "sneak peek" of the newly-completed facilities, which include the Photonics Laboratory and the Research in Advanced Antenna Technology Laboratory (RAATLab). The two labs will ensure CRC's continued research and development (R&D) leadership in the areas of photonics and antenna technologies.

A short opening ceremony was led by CRC President Veena Rawat, with the help of the ADM of Industry Canada's Spectrum, Information Technologies and Telecommunications Sector, Michael Binder, and the Interim Chair of CRC's Board of Directors, Tom Hope. Other attending guests included senior representatives from Algonquin College, Nortel, the Canadian Space Agency, Defence R&D Canada and from various universities.

*Tom Hope (left), the Interim Chair of CRC's Board of Directors, cuts a ribbon to symbolize the opening of the Photonics Laboratory, accompanied by Veena Rawat, CRC President, and Michael Binder, ADM, Spectrum, Information Technologies and Telecommunications Sector, Industry Canada.*

Following the program, guests enjoyed a preview of both labs, guided by researchers who will work in the new facilities under the direction of Bob Kuley, who leads CRC's photonics group, and Michel Cuhaci, leader of the research team in antenna technologies.

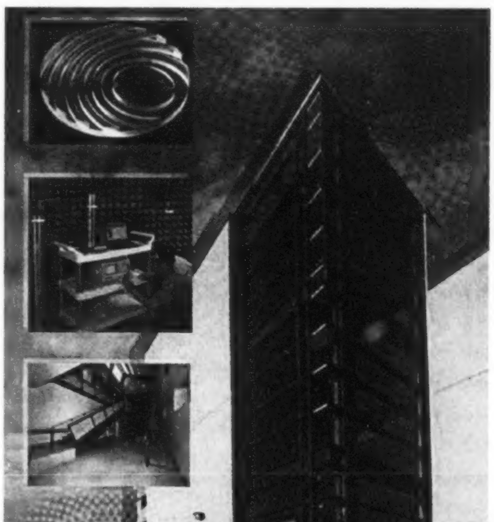
Antenna research is used in the development of any system that is wireless, ranging from cell phones and laptops to major satellite systems. The new RAATLab provides the research team with access to two different modes of antenna measurement – a shielded anechoic far-field antenna measurement chamber (1 to 40 GHz) and a shielded anechoic compact range for antenna measurement (2 to 100 GHz). The group has a well-established research network with several Canadian universities and conducts R&D through a combination of in-house, university and industry participation. The network is used to coordinate research activities and complement the participants' expertise.

The knowledge base accumulated through the antenna research program is made available to Industry Canada, National Defence and other government departments or agencies for the development of new wireless communication systems, regulations and policies, and to Canadian industry for commercial exploitation. Technology transfer to industry is a primary objective and is achieved through the licensing of prototypes, knowledge transfer as part of collaborative R&D, and on-the-job training of Canadian university students who are later employed by industry.

CRC's new Photonics Lab is a 40,000 square-foot expanded facility, with new laboratories, equipment and offices for staff and guest workers. Recognized as a Canadian pioneer in optical communications, CRC has been involved in photonics R&D for more than 30 years. Throughout its rich history, CRC has been credited for a number of technological breakthroughs in the field.

One of the most notable milestones is CRC's discovery of UV photosensitivity, which has been recognized as one of the four major milestones in the development of optical communications technology. CRC is also world-renowned for its invention of several types of Fibre Bragg Grating (FBG) components, which generated a FBG fabrication industry essential to the use of optical communications systems today. Nearly 50 companies worldwide, including six Canadian companies and several successful spin-offs, have licensed this technology from CRC. The resulting Intellectual Property (IP) revenues to CRC from FBG since 1994 total more than $10,000,000. Globally, the total sales of FBGs since 1999 is estimated at $800 million, of which Canadian companies account for approximately 20 per cent.

Most recently, CRC patented the ultrafast IR laser technique for Bragg grating inscription, which induces photosensitivity in any transparent optical material. This new technology promises to expand the application of Bragg gratings into crystalline materials for nonlinear optical switches, high-power fibre lasers and high temperature fibre-optic sensors.



*Images of CRC's new Photonics Laboratory and Research in Advanced Antenna Technology Laboratory (RAATLab).*

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*CRC equipment set up for testing broadcast signals on Parliament Hill, where CRC executives recently advised the Canadian Heritage Committee on the future of broadcasting technologies.*

### *The Future of Broadcasting: CRC Invited by House of Commons Standing Committee*

Canada's House of Commons recently invited the Communications Research Centre Canada (CRC) to lend its expertise in the area of broadcasting technologies.

On May 10, 2007, two executives from the CRC made a presentation to the Standing Committee on Canadian Heritage for the House of Commons. Dr. Veena Rawat, President of CRC, along with Bernard Caron, Vice-President of CRC's Broadcast Technology branch, participated in a panel discussion to investigate the role of the public broadcaster in the 21st century. The panel's other participants included professors from the University of Ottawa and McMaster University, as well as a representative from the National Film Board of Canada.

CRC's role in the discussion was to present its expertise on various technological developments that may impact the way broadcasters operate in the future, particularly in the case of over-the-air transmissions. Mr. Caron addressed a number of specific broadcast technologies, including High Definition Television (HDTV) and Digital TV (DTV), which offers the potential for mobile transmission capabilities in environments such as cars, buses or trains. In addition, he spoke about Digital Radio as well as Emergency Broadcasting and distributed transmitter networks for regional coverage.

The CRC representatives left the panel with the message that these emerging broadcasting technologies have the potential to provide Canadians with an increased number of services, as well as higher-quality services. Despite the value of digital broadcasting systems and their increasing implementation worldwide, the technology world is not yet ready to abandon terrestrial broadcasting for satellite or the Internet.

CRC representatives also fielded questions related to Canada's broadcasting infrastructure, and supplied suggestions as to how we might make upgrades while remaining cost effective.

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For example, old analog transmitter towers stationed in Quebec City could be converted to digital towers capable of transmitting HDTV programs free of charge. As the digital towers are smaller and use less power, in the end the total cost should be lower.

As the federal government's primary research laboratory in advanced communications technologies, CRC has the only laboratories dedicated to the evaluation of advanced digital broadcasting technologies in Canada. For many years, the CRC has been collaborating with the broadcasting industry, including the CBC, to develop and evaluate various technologies. Canadian broadcasters can use these technologies to address some of the challenges in today's environment, including rapidly-changing telecommunications technologies, new delivery mechanisms and the high demand for consumer interactivity.

The mandate of the House of Commons Standing Committee on Canadian Heritage is to play a central role in supporting cultural, artistic and civic activity in Canada, and to preserve and protect Canada's cultural and natural heritage and shared history. The Committee studies and reports on matters referred to it by the House of Commons or on topics that the Committee itself chooses to examine.

*The meeting was televised on CPAC. For more information, read CRC's oral presentation and corresponding PowerPoint Presentation.

## ▶▶▶ *Licensing Corner*

**CRC-developed SDR technology deployed in commercial radios**

The Communications Research Centre Canada (CRC) has achieved another first in the Software Defined Radio (SDR) industry – integrating its world-renowned technology into a commercial radio and shipping it to North American customers for deployment.

An emerging technology, SDR is a radio communication system that enables disparate handsets from different areas of the country to be able to communicate with each other through the use of specialized software. The CRC-developed Software Communications Architecture (SCA) V2.2 core framework is at the heart of the latest radio from Montréal-based Ultra Electronics, a leading global supplier of line-of-sight (LOS) radios and systems for mid-range tactical communications.

Earlier this month, the Tactical Communication Systems Division of Ultra Electronics announced that the 16Mb/s full-duplex version of its flagship AN/GRC-245 High-Capacity LOS radio has been delivered to several major customers. Ultra Electronics reports a strong demand for the new 16Mb/s radio, and has already secured a very large order backlog.

The technology behind SDR is applicable in public safety scenarios, such as linking various emergency services during a hurricane. SDR is also well-established within the military sector as the radio technology of the future. The SCA, part of CRC's SCARI Software Suite 2007, enables embedded systems manufacturers to leverage SDR for just about any industry, implementation or product. This will bring SDR technology to new domains, including the space, avionics, automobile, public safety and consumer electronics industries.

For more information about CRC's SDR products and services, please visit: www.crc.ca/sdr.

CRC's mission is to be the federal government's centre of excellence for communications R&D, ensuring an independent source of advice for public policy purposes. CRC, an agency of Industry Canada, also aims to help identify and close the innovation gaps in Canada's communications sector by:

- *engaging in industry partnerships;*
- *building technical intelligence;*
- *supporting small and medium-sized high technology enterprises.*